

What is claimed is:

1. A peer-to-peer relay network, comprising:  
a plurality of  $N$  peer systems;  
5 wherein each peer system is connected to a number of other peer systems that is less than or equal to a connection limit,  
said connection limit is greater than or equal to 2,  
said connection limit is less than or equal to  $N-2$ , and  
each peer system is configured to relay data to peer systems connected to that peer  
10 system according to a set of one or more relay rules.
2. The peer-to-peer relay network of claim 1, wherein:  
each peer system is configured so that when a peer system receives data from a  
sending peer system, the peer system sends the data to each of the peer systems  
15 connected to the peer system, but the peer system does not send the data back to the  
sending peer system and the peer system does not send the data to any peer systems if the  
peer system has already sent the same data.
3. The peer-to-peer relay network of claim 2, wherein:  
20 each peer system is configured to receive data included within a message, and  
each peer system is configured to retrieve identification information from a  
message to determine if a message including the same data has already been sent by the  
peer system.
- 25 4. The peer-to-peer relay network of claim 1, wherein:  
each peer system is configured to relay data using messages, and  
a message includes data to be relayed, an origin identifier, a sequence value, and  
addressing information.
- 30 5. The peer-to-peer relay network of claim 1, wherein:  
the data relayed by peer systems is update data for a network environment.

6. The peer-to-peer relay network of claim 1, wherein:  
the data relayed by peer systems is update data for an online game.

5 7. The peer-to-peer relay network of claim 1, wherein:  
at least one peer system is a network-enabled game console.

8. The peer-to-peer relay network of claim 1, further comprising:  
a server connected to each of the peer systems.

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9. The peer-to-peer relay network of claim 1, wherein:  
each peer system has a respective value for said connection limit.

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10. The peer-to-peer relay network of claim 1, wherein:  
the value of said connection limit changes dynamically.

11. The peer-to-peer relay network of claim 1, wherein:  
at least two peer systems are connected through the Internet.

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12. A server for a peer-to-peer relay network, comprising:  
means for establishing a peer-to-peer relay network;  
means for adding a peer system to a peer-to-peer relay network;  
means for maintaining a peer-to-peer relay network; and  
means for tracking connections in a peer-to-peer relay network.

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13. A peer system for a peer-to-peer relay network, comprising:  
means for relaying data to any other peer systems connected to said peer system  
in a peer-to-peer relay network;  
means for establishing a peer-to-peer relay network;  
30 means for joining a peer-to-peer relay network;  
means for connecting to another peer system in a peer-to-peer relay network;

means for maintaining a peer-to-peer relay network; and  
means for disconnecting from another peer system connected to said peer system  
in a peer-to-peer relay network.

- 5        14. A method of relaying data in a peer-to-peer relay network, comprising:  
receiving data at a relaying peer system from a sending peer system connected to  
said relaying peer system in a peer-to-peer relay network;  
applying a set of one or more relay rules to select zero or more peer systems  
indicated by said set of one or more relay rules to which to relay said data; and  
10       relaying said data to any peer systems selected by applying said set of one or  
more relay rules.

- 15       15. The method of claim 14, wherein:  
said set of one or more relay rules indicate that the relaying peer system is not to  
relay to the sending peer system the same data received from the sending peer system.

- 20       16. The method of claim 14, wherein:  
said set of one or more relay rules indicate that the relaying peer system is not to  
relay the same data to the same peer system twice.

- 25       17. The method of claim 14, wherein:  
said set of one or more relay rules indicate that the relaying peer system is not to  
relay the data to the peer system indicated as the origin of the data according to  
information identifying the received data.

18. The method of claim 14, further comprising:  
storing information identifying the received data.

19. The method of claim 14, further comprising:

comparing information identifying said received data with information stored by the relaying peer system to determine if said received data has been previously received by the relaying peer system.

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20. The method of claim 14, wherein:

said received data is update data for a network environment.

21. The method of claim 14, wherein:

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said received data is update data for an online game.

22. The method of claim 14, wherein:

at least one peer system is a network-enabled game console.

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23. The method of claim 14, wherein:

at least two peer systems are connected through the Internet.

24. A method of adding a peer system to a peer-to-peer relay network, comprising:

opening a connection between a server and a joining peer system;

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providing grid information to said joining peer system indicating one or more established peer-to-peer relay networks;

receiving a grid selection from said joining peer system indicating a selected peer-to-peer relay network, wherein said selected peer-to-peer relay network has one or more member peer systems;

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providing network addresses of each of said one or more member peer systems to said joining peer system; and

receiving a connection update from said joining peer system indicating to which member peer systems said joining peer system is connected;

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wherein each member peer system is connected to a number of other member peer systems that is less than or equal to a connection limit and each member peer system

stores a set of one or more relay rules for relaying data to the other member peer systems connected to that member peer system.

25. The method of claim 24, further comprising:

5        opening a connection between said server and an establishing peer system,  
wherein the establishing peer system is one of said member peer systems;

      receiving a request to create said peer-to-peer relay network from said  
establishing peer system;

      registering said peer-to-peer relay network in storage; and

10       sending a creation confirmation to said establishing peer system.

26. A method of joining a peer-to-peer relay network, comprising:

      sending a join message from a joining peer system to each of one or more  
member peer systems in a peer-to-peer relay network;

15       receiving a join response from at least one of said one or more member peer  
systems, wherein each join response is positive or negative, and a positive join response  
indicates the sending member peer system has an available connection and a negative  
join response indicates the sending member peer system does not have an available  
connection;

20       selecting one or more member peer systems up to a connection limit according to  
a set of one or more connection rules;

      opening a connection with each selected member peer system;

      wherein each member peer system is connected to a number of other member peer  
systems that is less than or equal to said connection limit and each member peer system  
25       stores a set of one or more relay rules for relaying data to the other member peer systems  
connected to that member peer system.

27. The method of claim 26, wherein:

30       a member peer system has an available connection if the member peer system has  
a number of open connections to other member peer systems that is less than said  
connection limit.

28. The method of claim 26, wherein:

selecting one or more member peer systems includes storing a response time for each received join response.

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29. The method of claim 26, wherein:

selecting one or more member peer systems includes:

selecting the member peer system from which the positive join response that is received first by said joining peer system, and

10 selecting the member peer system from which the positive join response that is received last by said joining peer system within a time limit.

30. The method of claim 29, wherein:

selecting one or more member peer systems includes substantially randomly

15 selecting additional member peer systems up to said connection limit from among the remaining unselected member peer systems from which positive joint response have been received.

31. The method of claim 29, wherein:

20 selecting one or more member peer systems includes selecting additional member peer systems up to said connection limit from among the remaining unselected member peer systems from which positive joint response have been received in the order in which the positive joint responses were received.

25 32. The method of claim 26, wherein:

selecting one or more member peer systems includes:

selecting a member peer system from which a negative join response has been received as a force connection peer system;

30 sending a force connection request to said force connection peer system, wherein said force connection request requests that said force connection peer system close one of the open connections of said force connection peer system; and

receiving a force connection confirmation from said force connection peer system.

33. The method of claim 32, wherein:

5        selecting said force connection peer system includes applying said set of one or more connection rules to the member peer systems that sent negative join responses.

34. The method of claim 26, further comprising:

opening a connection between a server and said joining peer system;  
10        receiving grid information at said joining peer system indicating one or more established peer-to-peer relay networks;  
          sending a grid selection from said joining peer system to said server indicating a selected peer-to-peer relay network, wherein said selected peer-to-peer relay network has one or more member peer systems;  
15        receiving network addresses of each of said one or more member peer systems at said joining peer system; and  
          sending a connection update from said joining peer system indicating to which member peer systems said joining peer system is connected;

20        35. A method of establishing a peer-to-peer relay network, comprising:

opening a connection between said server and an establishing peer system,  
wherein the establishing peer system is one of said member peer systems;  
          sending a request to create said peer-to-peer relay network from said establishing peer system to said server;  
25        receiving a creation confirmation at said establishing peer system from said server;  
          wherein said establishing peer system stores a connection limit defining a number of other peer systems up to which said establishing peer system is permitted to connect, and said establishing peer system stores a set of one or more relay rules for relaying data  
30        to other peer systems connected to said establishing peer system.

36. A method of connecting peer systems in a peer-to-peer relay network, comprising:

sending a connection available message from a disconnected peer system to one or more member peer systems in a peer-to-peer relay network when said disconnected peer system has a number of open connections to member systems that is less than a

5 connection limit;

receiving a connection available response from at least one of said one or more member peer systems, wherein each connection available response is positive or negative, and a positive join response indicates the sending member peer system has an available connection and a negative join response indicates the sending member peer  
10 system does not have an available connection;

selecting a member peer system according to a set of one or more connection rules;

opening a connection with said selected member peer system;

wherein each member peer system is connected to a number of other member peer  
15 systems that is less than or equal to said connection limit and each member peer system stores a set of one or more relay rules for relaying data to the other member peer systems connected to that member peer system.

37. The method of claim 36, further comprising:

20 closing a connection by said disconnected peer system.

38. The method of claim 36, wherein:

a member peer system has an available connection if the member peer system has a number of open connections to other member peer systems that is less than said  
25 connection limit.

39. The method of claim 36, wherein:

selecting a member peer system includes storing a response time for each received connection available response.

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40. The method of claim 36, wherein:

selecting a member peer systems includes selecting the member peer system from which the positive connection available response that is received first by said disconnected peer system.

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41. The method of claim 36, wherein:

selecting a member peer systems includes not selecting a member peer system from which said disconnected peer system has disconnected within a disconnection time period.

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42. The method of claim 36, wherein:

selecting a member peer systems includes:

selecting a member peer system from which a negative connection available response has been received as a force connection peer system;

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sending a force connection request to said force connection peer system, wherein said force connection request requests that said force connection peer system close one of the open connections of said force connection peer system; and

receiving a force connection confirmation from said force connection peer system.

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43. The method of claim 42, wherein:

selecting said force connection peer system includes applying said set of one or more connection rules to the member peer systems that sent negative connection available responses.

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44. The method of claim 36, further comprising:

sending an update to a server indicating a connection has been opened between said disconnected peer system and said selected member peer system.

45. A method of maintaining a peer-to-peer relay network, comprising:  
    sending a maintenance message from a peer system to each of one or more  
connected peer systems connected to said peer system in a peer-to-peer relay network;  
    evaluating any responses received from said one or more connected peer systems;  
5    and  
    closing the connection between said peer system and a connected peer system if  
the response from that connected peer system is not acceptable;  
    wherein each peer system is connected to a number of other peer systems that is  
less than or equal to a connection limit and each peer system stores a set of one or more  
10    relay rules for relaying data to the other peer systems connected to that peer system.

46. The method of claim 45, wherein:  
    said maintenance message is a ping message.

15    47. The method of claim 45, wherein:  
    a response from a connected peer system is not acceptable if the response is not  
received by said peer system within a time limit.

48. The method of claim 45, wherein:  
20    a response is considered not acceptable if the response is not received.

49. The method of claim 45, wherein:  
    a response from a connected peer system is considered not acceptable if said peer  
system has not received a response from that connected peer system within a time limit  
25    multiple times.

50. The method of claim 45, further comprising:  
    sending a connection status request to a server for a connection between said peer  
system and a connected peer system if the response from that connected peer system is  
30    not acceptable.

51. The method of claim 45, further comprising:

sending an update to a server indicating a connection has been closed for each connection closed by said peer system.

5 52. A computer program, stored on a tangible storage medium, for use in a server for peer-to-peer relay network, the program comprising executable instructions that cause a computer to:

establish a peer-to-peer relay network;

add a peer system to a peer-to-peer relay network;

10 maintain a peer-to-peer relay network; and

track connections in a peer-to-peer relay network.

53. A computer program, stored on a tangible storage medium, for use in a peer system for a peer-to-peer relay network, the program comprising executable

15 instructions that cause a computer to:

relay data to any other peer systems connected to said peer system in a peer-to-peer relay network;

establish a peer-to-peer relay network;

join a peer-to-peer relay network;

20 connect to another peer system in a peer-to-peer relay network;

maintain a peer-to-peer relay network; and

disconnect from another peer system connected to said peer system in a peer-to-peer relay network.

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